escopeta oil

Environmental Sampling Effort
Kitchen Lights Unit

September 2011

JACOBS

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TABLE

APPENDICES

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LIST OF ACRONYMS AND ABBREVIATIONS

°C	degrees centigrade
BUD	back up device
CMI	Coastal Marine Institute
EOC	Escopeta Oil Company, LLC
EPA	U.S. Environmental Protection Agency
Jacobs	Jacobs Engineering Group Inc.
KLU	Kitchen Lights Unit
m	meters
MMS	Minerals Management Service
mS/cm	milliSiemens per centimeter
NOAA	National Oceanic and Atmospheric Association
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NTU	nephelometric turbidity unit
PSU	practical salinity units
ppt	parts per thousand
USGS	U.S. Geological Survey

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1.0 EXECUTIVE SUMMARY

Escopeta Oil Company, LLC (EOC) contracted Jacobs Engineering Group Inc. (Jacobs) to conduct environmental monitoring services in support of exploration drilling activities in the Kitchen Lights Unit (KLU), Cook Inlet, Alaska. Planned activities included collecting 16 primary sediment samples and three water column quality readings before drilling, during drilling, and after drilling at the exploratory well KLU #1 location. Sample collection prior to drilling was attempted on 4 and 5 August 2011. However, due to seafloor site conditions, the sediment samples were not collected. Planned water column readings were collected and are presented in this report.

2.0 SITE HISTORY AND DESCRIPTION

2.1 PROJECT BACKGROUND

EOC is proposing to drill exploratory wells in the upper Cook Inlet as outlined in the EOC *2011 Modification Plan of Operations* (EOC 2011). The proposed exploration well sites are located in the Kitchen Lights Unit offshore in State waters approximately 10 miles north of Boulder Point near Nikiski, Alaska (Figure 1).

2.2 ENVIRONMENTAL SETTING

Cook Inlet is a shallow tidal estuary in Southcentral Alaska filling a large portion of a northeast-southwest trending foreland basin, also known as the Susitna Lowland (U.S. Geological Survey [USGS] 1996). The Inlet is a v-shaped trough with shallow platforms on the eastern and western sides. Water depths range from 65 feet on the platforms to 260 feet within the trough (Minerals Management Service [MMS] 1996). Cook Inlet tides, while not as extreme as the narrow Turnagain and Knik Arms, regularly reach 25 feet and exhibit currents in excess of 5 knots at full tidal flow (National Oceanic and Atmospheric Administration [NOAA] 2008). The Inlet basin is surrounded by mountains in every direction except in the south where it opens into the Gulf of Alaska and Shelikof Straight. According to the Escopeta Plan of Operations (EOC 2011), the proposed drilling area for exploratory well KLU #1 is located in the north-central part of the Inlet, just east of Trading Bay (Figure 1).

2.3 PERMITTING

EOC provided a Notice of Intent (NOI) for coverage under National Pollutant Discharge Elimination System (NPDES) General Permit AKG-31-5000 (AKG-31-5000) for oil and gas exploration drilling in the coastal waters of the upper Cook Inlet. The purpose of the permit application was to provide EOC with authorization to discharge during drilling activities (U.S. Environmental Protection Agency [EPA] 2011). AKG-31-5000 requires new exploratory facilities to submit a plan of study for environmental monitoring to the EPA for review with, or prior to, submission of a NOI. The objective of the environmental monitoring was to examine the fates and effects of hydrocarbon and heavy metals in drilling muds and/or cuttings discharged to Cook Inlet. Monitoring was to include relevant hydrographic, sediment

hydrocarbon, and heavy metal data from surveys conducted before and during drilling mud disposal and up to a least one year after drilling operations cease.

As stated in the NPDES permit (EPA 2011), EOC developed a probability-based sampling design to provide an unbiased estimate over a site-specific area from a small number of samples. The following general activities were planned at each well location:

- Monitor to establish current directions. Screen for temperature, salinity, and turbidity at three intervals within the water column at three locations during each monitoring event.
- Establish baseline data by collecting 16 benthic sediments samples (eight systematic samples and eight random simple grid samples) once before drilling.
- Establish discharge data by performing systematic sampling once during drilling using the original eight locations from the baseline data effort, plus eight additional samples using a random simple grid. This was to occur specifically during discharge of water-based drilling fluids and drilling mud-coated cutting.
- Establish post-drilling data by sampling the original eight locations plus eight additional samples using a random simple grid within one year after the rig has moved offsite.

3.0 FIELD ACTIVITIES

Jacobs personnel boarded the Thunder research vessel in Homer, Alaska on 4 August 2011. The vessel traveled north through Cook Inlet to the area offshore of the OSK dock in Nikiski.

3.1 SEDIMENT SAMPLING

Due to the large tides and strong currents typical of the KLU area, sample collection was attempted at the slack tide, as well as the hour on either side of the slack tide.

While waiting for the slack tide, Jacobs personnel practiced deploying the VanVeen sampler to collect seafloor sediment samples. In the sheltered area near the dock with only a slight current, the VanVeen collected approximately 1.5 liters of sediment. Jacobs personnel also deployed the YSI 6920 V2 sonde and determined the sensors were recording data properly.

During the first slack tide at KLU #1, the VanVeen sampler was deployed five times in an attempt to collect sediment. Each attempt was along the centerline of the grid (Figure 2) where systematic sampling was planned. However, even during the slack tide, the boat was drifting at approximately 2.5 knots, causing difficulty in targeting the specified systematic sample locations; therefore, there are no exact locations available for each attempt. On each of the five attempts, the sampler came up to the surface empty with no sediment or rocks.

A backup device (BUD) for sampling consisting of a 6-inch by 4-inch rectangular steel pipe 24-inches in length was then deployed two times and dragged along the entire centerline of the grid (Figure 2). Jacobs personnel could feel the rocky bottom through the Spectra® rope used to deploy the BUD as it was being dragged along the seafloor. Through the two attempts, only three small cobbles were collected (refer to the photograph log, Photo No. 4). The boat

then moved approximately 50 meters northwest of the center gridline and another collection was attempted using the BUD. More large rocks were felt, and the BUD came up empty. The boat then moved southeast of the center gridline and deployed the BUD. Again, large rocks were felt and the BUD came up empty.

During the next slack tide, the BUD was deployed for the length of the grid on both the northwest and southeast sides. Again, the BUD contacted only large rocks and hard substrate as felt on the surface through vibrations in the line. Two cobbles were collected during these two attempts. The position of the outer limit of the attempts was recorded by the vessel's onboard geographic positioning system (GPS) (Figure 2).

3.2 WATER QUALITY SAMPLING

Water quality samples were collected at three locations using a YSI 6920 V2 sonde. Target locations were downgradient from the KLU #1 location along the incoming tide direction (SS1), downgradient along the outgoing tide location (SS2), and crosscurrent (SS3) (Figure 2). The starting and ending positions of the boat during the first two deployments were recorded with the onboard GPS for the incoming and outgoing tide locations (Figure 2). The crosscurrent location was recorded as the mid-point of the drift at slack tide.

At each location, readings were continuously logged from the surface to the bottom as the sampler was deployed. The sampler was held at three target depths to allow the instrument to readings to stabilize: 1 meter below the sea surface, halfway between the sea surface and the seafloor, and 2 meters above the sea floor. With the strong currents, it was difficult to get the meter to drop straight down through the water column but target depths were eventually achieved through maneuvering the boat in the current.

Readings of depth, temperature, conductivity, turbidity, and salinity were collected at 10-second intervals as the YSI sonde was lowered through the water column. Upon retrieval of the sonde, measurements were immediately downloaded onto the handheld display to ensure the target depths and proper measurements were recorded. Between three and seven individual measurements at each depth were averaged and the average value and standard error margin are reported in Table 1.

Table 1
Water Quality Data

Sample ID	No. of Readings	Depth (m)	Temperature (°C)	Specific Conductivity (mS/cm)	Turbidity (NTU)	Salinity (ppt)
SS1	7	1.67±0.00	12.42±0.28	0.05±0.00	0.1±0.02	0.02±0.00
	7	16.46±0.52	13.43±0.01	35.07±0.02	66.47±0.12	22.10±0.01
	7	26.71±0.60	13.44±0.00	35.16±0.01	68.13±0.11	22.16±0.01
SS2	7	1.66±0.00	13.66±0.51	0.40±0.03	-0.09±0.05	0.19±0.01
	3	15.38±1.94	13.38±0.01	35.37±0.07	67.83±0.43	22.30±0.05
	5	26.91±1.09	13.42±0.00	35.52±0.00	69.34±0.07	22.41±0.00
SS3	7	1.78±0.07	12.32±0.38	15.08±6.89	122.6±66.61*	9.45±4.35
	3	5.49±0.86	13.29±0.00	34.56±0.00	59.47±0.38	21.74±0.00
	7	28.02±1.34	13.39±0.00	35.74±0.00	68.87±0.12	22.56±0.00

Notes:
The results reported are averages over n readings plus/minus 1 standard error.
Turbidity values for SS3 at the depth of 1.78 ± 0.07 meters ranged from -0.4 to 442.5 NTU on the way down into the water column and -0.2 to 0 NTU on the way up suggesting the high range measurements may not be representative of turbidity values for that depth.

The average temperature was consistent among all locations and depths ranging between 12.32 °C and 13.66 °C. Salinity, specific conductivity, and turbidity were notably different at the shallow depth interval for all three locations when compared to the two deeper intervals. The low salinity and specific conductivity values as well as the variable turbidity recorded at the shallow depth interval, approximately 1 meter below the surface, could be influenced by an influx of freshwater or other environmental factors such as winds, tides, or current. Measurements made halfway between the sea surface and the seafloor, and 2 meters above the sea floor for salinity, specific conductivity, and turbidity were similar among all three locations.

Water column sample results at these locations were within range of values measured by the Coastal Marine Institute (CMI) during the spring and fall of 2002 for the Forelands area (Okkonen and Howell 2003). Average temperature recorded for this region by CMI was 11 °C with a salinity of 18 practical salinity units (PSU) at the surface and 24.5 PSU at the deepest point. Both PSU and parts per thousand (ppt) are a measure of salinity with PSU normalizing the salinity measurement to the conductivity of the sample. The numeric difference between ppt and PSU is very small, indicating the result in the KLU #1 location are consistent with the values reported for the general vicinity by CMI in 2002.

4.0 CONCLUSIONS

The seafloor in the KLU #1 well location was found to be predominately rocks and cobbles. Pockets of sediment suitable for sample collection were not found despite attempts across the 810,000 square meter area. Given the currents and minimal slack tide encountered, it does not seem likely that sediment is settling at this location in appreciable amounts. Likewise, due to the current, it does not seem likely that any effluent or potential discharge from the EOC exploration drill rig would settle in the area.

Further attempts to obtain sediment samples from this location would require larger sampling devices or collection by diver or underwater rovers. Each of these alternatives would require a considerable amount of time, money and, in the case of diver-collected sediment, safety risks to coordinate and obtain samples. Based on what was found during this effort, there is no guarantee that sediment could be obtained.

Water measurements for conductivity, salinity, temperature, and turbidity appear to be within the range of results previously recorded in the Forelands area.

5.0 REFERENCES

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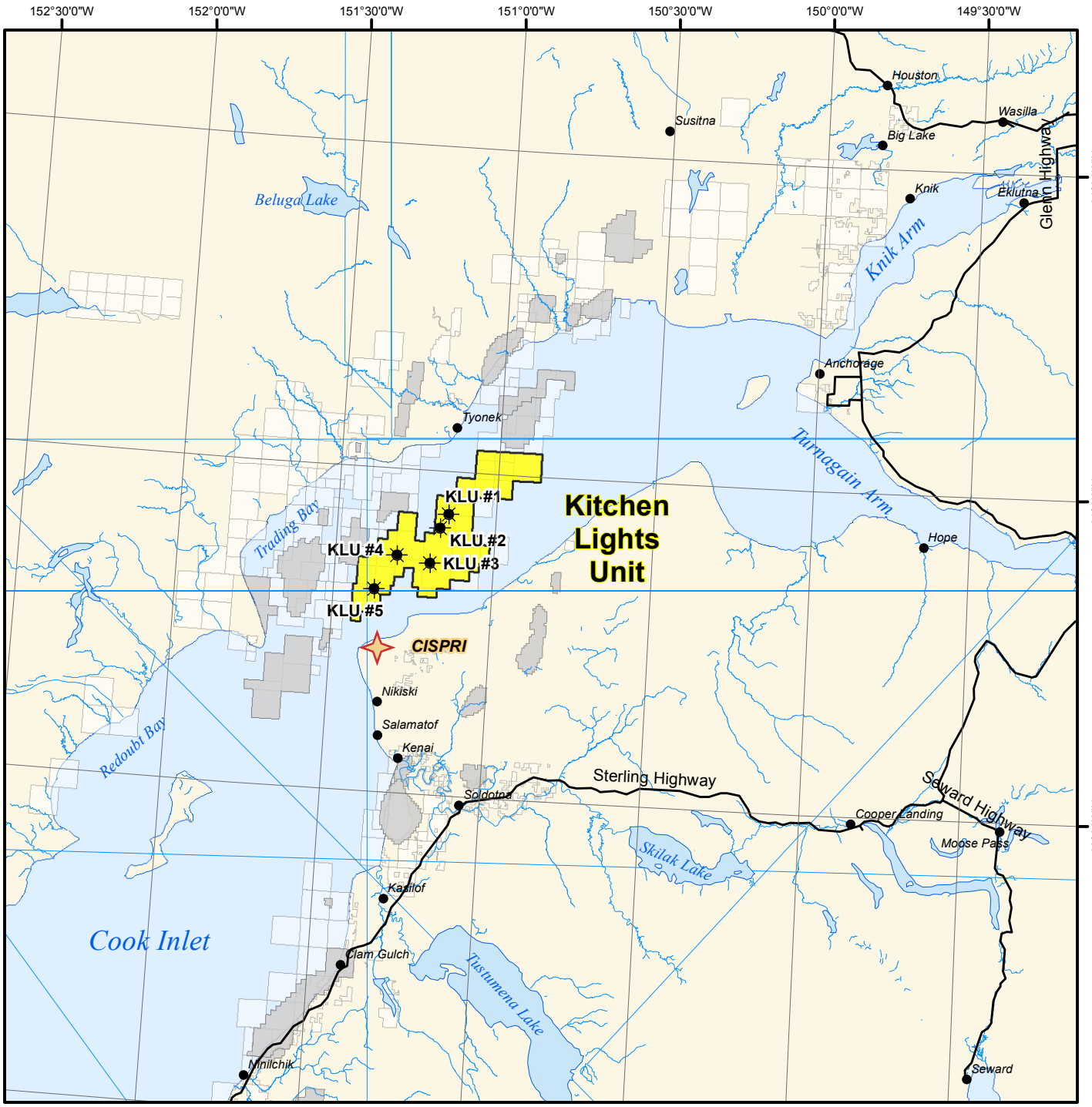
Okkonen, S.R. and S.S. Howell. 2003. *Measurements of Temperature, Salinity, and Circulation in Cook Inlet, Alaska.* Final Report. OCS Study MMS 2003-036, University of Alaska Coastal Marine Institute, University of Alaska Fairbanks and USDOI, MMS, Alaska OCS Region, 28 p.

USGS (U.S. Geologic Survey). 1996. *Digital Shaded Relief Image of Alaska*.

APPENDIX A
Figures



Kitchen Lights Unit
Oil & Gas Units
Active Leases

Cook Inlet Spill Prevention & Response, Inc.
Proposed Wells
Towns

N
W
E
S

Coordinate System: WGS 1984 UTM Zone 6N
Projection: Transverse Mercator
Datum: WGS 1984
Units: Meter

1:1,000,000

0 5 10 15 20
Miles

KITCHEN LIGHTS UNIT
GENERAL LOCATION MAP
COOK INLET, ALASKA

JACOBS	DATE:	PROJECT MANAGER:	FIGURE NO.:
	02 AUGUST 2011	T. HEIKKILA	1

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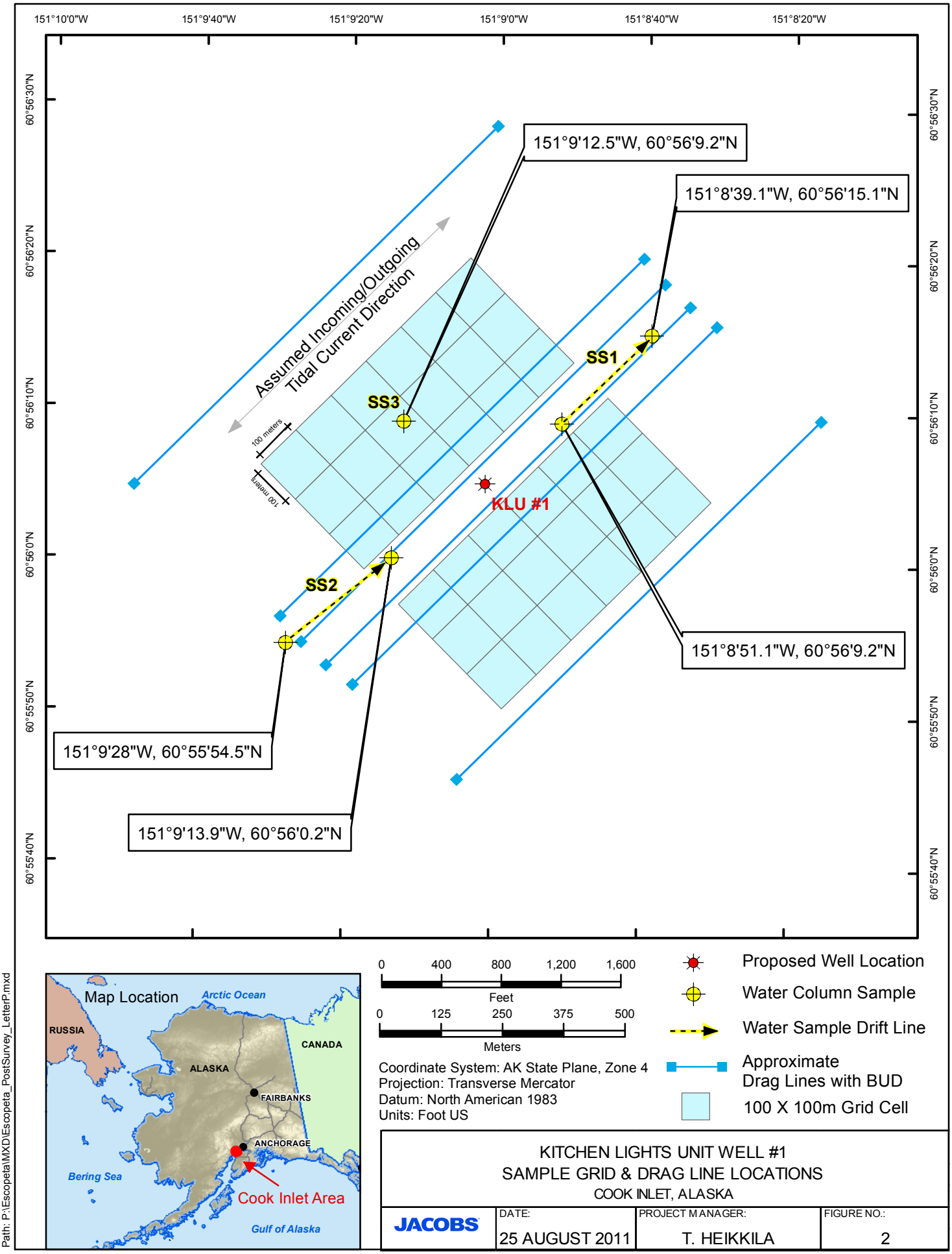

0 400 800 1,200 1,600
Feet

0 125 250 375 500
Meters

Coordinate System: AK State Plane, Zone 4
Projection: Transverse Mercator
Datum: North American 1983
Units: Foot US

- Proposed Well Location
- Water Column Sample
- Water Sample Drift Line
- Approximate Drag Lines with BUD
- 100 X 100m Grid Cell

KITCHEN LIGHTS UNIT WELL #1
SAMPLE GRID & DRAG LINE LOCATIONS
COOK INLET, ALASKA

JACOBS	DATE:	PROJECT MANAGER:	FIGURE NO.:
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APPENDIX B
Photograph Log

Photo No. 1
Jacobs personnel attempted to collect sediment samples using a VanVeen sampler.

Photo No. 2
Several attempts were made to collect sediment samples.

Photo No. 3
Attempts to collect sediment samples were also made using the sampling backup device.

Photo No. 4
Dragging the sampling backup device along the seafloor collected few cobbles.

Photo No. 5
Water quality samples were collected at three locations using a YSI 6920 V2 sonde.